

Teaching STEM to English-Language Learners

When the U.S. Department of Education released *The Nation's Report Card: Science 2011*, several national publications reported the results. They cited that the average score for eighth graders in the U.S. was 152, up from 150 in 2009. They bemoaned the fact that 32 percent of students performed at or above proficient, and only 2 percent performed at the advanced level—far below what's needed to prepare a 21st century work force.

Curiously, few mentioned the performance of English-language learners (ELLs), despite the fact that school-age children who speak a language other than English at home comprise 21 percent of the U.S. student population. According to *The Nation's Report Card*, the average score for ELLs was 106 versus 154 for non-ELLs. Since the National Assessment of Educational Progress (NAEP) science scale ranges from zero to 300, there is clearly room for improvement for all students, but especially for ELLs.

Many students—regardless of their native language—struggle with science because they don't understand the concepts that underlie this sometimes complicated subject. At Madison Park School of Dynamic Interactive Learning, we employ a science, technology, engineering, and math (STEM) focus, and use a blended learning model to deepen students' understanding of key concepts and skills. By combining teacher-led instruction and online learning, we are extending beyond the limits of traditional learning to prepare all students for success in the global marketplace. Here are some of the strategies we are employing.

Bridge the digital divide. At our middle school, 60 percent of students are Hispanic, 17 percent are ELLs, and 74 percent are economically disadvantaged. All students receive a laptop computer they use daily at school.

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If students want to take it home, we charge a \$50, one-time fee for the insurance. Local businesses also make scholarships available for families who cannot afford the fee. As a result, about 85 percent of students take their computers home regularly.

Provide professional development. It is vital, of course, to provide teachers with professional development—not just on how to use technology, but on how to use it to improve the quality of teaching and learning. It also is essential to provide students with their own “professional development.” Every student is required to take a technology class to develop the foundational skills they need to succeed in school and in life. Instead of focusing on the technology, we teach students how to use it in real-life situations. Students learn how to draft a letter to a bank, create a proposal, track accounting records in a spreadsheet, incorporate audio and video into presentations, create a blog, and more.

Differentiate and individualize learning. We integrate technology into our STEM instruction—as well as in every subject area—to help students. A key benefit is that technology allows us to customize learning to fit each student's individual level and pace, and provide immediate feedback and assessment. Self-paced, online lessons allow ELLs—or any student—to repeat an activity as many times as needed to ensure understanding, or to accelerate learning if they master concepts more quickly than their peers.

Use mixed modalities. A technology-infused curriculum that uses mixed modalities also helps ELLs and students with diverse learning styles increase their understanding. Activities that incorporate auditory, visual, and kinesthetic modalities, with multiple language supports, enable students to develop deeper, stronger connections between the English language and the STEM content.

Connect concepts to the real world. Asking students to connect concepts and apply them to real world situations is another way to deepen students' learning. Technology is particularly useful in this respect because it allows students to engage in hands-on, virtual learning experiences, including those that otherwise couldn't be done in class because of safety issues or a lack of equipment or materials.

In our STEM program, we use a Web-based, concept-mastery program called Adaptive Curriculum, which includes activities in English and Spanish, to engage students in core concepts. The program's real world scenarios, animations, videos and three-dimensional models help both fluent English speakers and English learners improve their understanding of difficult or abstract concepts.

For example, in an online instructional unit on endothermic and exothermic reactions, students experiment with heat energy changes in chemical reactions. They mix substances and observe temperature changes, and learn the differences

between these two reactions as well as how to use them in combination. This active learning approach engages students and takes learning to a higher level by motivating them to explore, make hypotheses, manipulate items, and see the impact of their decisions.

Use data to inform instruction. Our teachers regularly use data to differentiate instruction to address students' needs. They use a data warehouse called D2SC to track students' progress on state and district indicators. They also use Northwest Education Association's MAP for math to measure student growth. This is especially useful with students at the extreme high and low ends of the scale who are typically difficult to measure. This system benefits our ELL students by providing ongoing assessment of their academic growth that we can attribute to their ongoing success with language acquisition.

Extend communication beyond the classroom. Our teachers also use a free Web application called Moodle to give students an online source for assignments and access to resources. Additionally, Moodle acts as a teacher-to-student and student-to-student communication tool, which extends learning beyond the classroom. This feature—which we use campus wide—allows students to review subject matter and learning outcomes at their pace. Since it is Web-based, students can also easily translate any portion they need better clarity with to fully understand the task.

Encourage student exploration. A STEM curriculum should promote inquiry and curiosity, resulting in students wanting to understand the material and learn more. We quickly discovered the importance of allowing students to use technology to build upon their own interests, rather than strictly limiting its use. Providing students with the opportunity to explore and show us the ways STEM concepts connect to their lives creates more meaningful learning experiences.

Overall, we've found that implementing a blended learning model within our STEM program helps teachers meet the needs of English learners and fluent English speakers more quickly and effectively than traditional instruction alone. Students are more excited about

learning and more confident in their STEM skills, and we're seeing improved attendance and achievement as a result. **P**

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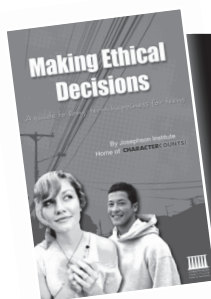
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